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# PUBLIC HEALTH REPORTS

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## IS YOUR WATER SUPPLY SAFE?

Experience has shown that a large proportion of the public water supplies in this country are so inadequately safeguarded that they constitute, at least potentially, serious sources of water-borne disease. No wonder, therefore, that in many communities the prevalence of typhoid fever is so high as to be a disgrace. The attention of our readers is invited to the interesting and instructive article describing an outbreak of typhoid fever in Herkimer, N. Y. This shows the spectacular, epidemic type of outbreak associated with a high degree of pollution. Health officers and local government officials should remember, however, that constant high typhoid prevalence, even though not in the form of an epidemic outbreak, is very often traceable to a polluted public water supply.

If you are in doubt as to your own community's supply, why not consult the State health officer? As may be seen from the list printed on pages 622 and 623, the Public Health Service has published a number of instructive bulletins dealing with typhoid fever and water supplies. Copies of these may be had on request to the Surgeon General, United States Public Health Service, Washington, D. C.

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## WATER-BORNE TYPHOID FEVER OUTBREAK IN HERKIMER, N. Y.<sup>1</sup>

By THEODORE HORTON, Chief Engineer, New York State Department of Health.

The following report of a water-borne outbreak of typhoid fever in Herkimer, N. Y. is particularly instructive because it illustrates the disastrous results which may follow the temporary failure, because of lack of expert supervision, to chlorinate a seriously contaminated water supply. It may also be of interest as showing the measures adopted by the State department of health in controlling the outbreak.

Briefly reviewed, the history of the outbreak is as follows: Between September 1, 1918, and January 1, 1919, some 155 cases of typhoid

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<sup>1</sup> In the compilation of this material the author desires to acknowledge his indebtedness to Mr. E. S. Chase, Assistant Engineer, Dr. J. E. Clark, and Dr. R. W. E. Cole, Sanitary Supervisors; F. W. Jones and Earl Devendorf, Assistant Engineers; Dr. A. L. Fagin, Health Officer, Eva M. Schied, County Nurse; Mary B. Hofmeister, Village Nurse; and William Ownes, Milk Inspector.

fever were reported from Herkimer. Upon the discovery of an undue prevalence of typhoid in the village, an epidemiological investigation was started in October, 1918, by the Division of Communicable Diseases, and an investigation of the water supply was made by the Engineering Division. The information secured by these two investigations pointed conclusively to an infection of the public water supply as the primary source of the outbreak.

It appears that on August 28, 1918, it was considered necessary by the municipal authorities to augment the regular well supply of the village by pumping directly from the hydraulic canal by means of the fire pump at the Herkimer Fiber Co. While an attempt was made to sterilize this emergency supply by means of liquid chlorine, the arrangement of the apparatus was such that the chlorine was not properly applied. Again on September 5, 6, and 7 unchlorinated canal water was pumped into the distribution system, and, furthermore, the regular well supply was unchlorinated on September 1, 2, 5, 6, and 7. The use of the canal was discontinued on September 29, and about this time the suction of one of the pumps at the village pumping station was rearranged so as to permit direct pumping from West Canada Creek with chlorination. Subsequent to the 7th of September the entire supply of the village was treated more or less continuously with chlorine, although from the records of operation there would appear to be some doubt as to the adequacy of the treatment until about November 25 when supervision of the chlorination was assumed by the Engineering Division.

On September 23, October 8, and October 22 the water supply was visited by engineers from this department. Each time the chlorination apparatus was found to be properly operating and the samples collected at these times were free from active contamination. Records, however, of operation of the chlorination apparatus and the results of analyses made for the village by Prof. Hodges, of Utica, indicate that there were times when adequate sterilization of the supply was not being obtained even after the visits of our engineers and after the admonitions of the department with respect to the extreme importance of proper sterilization. It was accordingly considered advisable, particularly in view of the continuation of reported cases of typhoid subsequent to our report of October 25, for this division to maintain temporary supervision of the chlorination of the water supply. This supervision was begun on November 25, and from that date until December 20 an engineer from the department was detailed to remain in Herkimer in constant touch with the situation. During this period the pumping station was visited several times daily and even during the night. Frequent chemical tests were made to determine the presence of excess chlorine in the treated water, it being planned to apply sufficient amounts of

chlorine to permit the existence of a marked excess in the treated water at the end of 5 minutes. The chlorine was applied to the water from the infiltration gallery at a rate of about 0.5 parts per million and to the creek water at a rate of about 1.5. These rates were varied somewhat from time to time as was found necessary. Samples for laboratory examination were collected about twice each week, and the results of the analyses of these samples, made by the Division of Laboratories and Research, will be found appended in Table 3.

In addition to the supervision of the chlorination, numerous conferences were held with and communications sent to the municipal authorities urging the necessity of the greatest care and efficiency in the operation of the chlorination apparatus. Upon our urgent recommendation two men were appointed by the village to observe and record the operation of the chlorine apparatus. These men were appointed and went on duty on December 15 and were carefully instructed by our engineer as to the proper operation of the chlorine apparatus. Tests for excess chlorine are made at two-hour intervals by these men, and strict orders have been issued to stop pumping should any trouble develop with the operation of the chlorination apparatus. Records of operation are kept on specially prepared forms and are checked over by our engineers who now visit Herkimer at weekly intervals. In view of the fact that practically no cases of typhoid have been reported recently, it appears very probable that the outbreak has been definitely checked and that little danger of its recurrence is to be expected, provided the chlorination of the supply is carried on as efficiently as it has been since November 25, 1918.

Two sets of six wells each have been drilled several hundred feet southwest of the pumping station, and it is expected that as soon as these wells are connected with the distribution system it will be no longer necessary to pump directly from West Canada Creek. Chlorination apparatus are to be provided for these sets of wells and the water will be chlorinated. The location of these wells on the outskirts of a thickly settled community is not satisfactory for a permanent source of supply, due to the numerous opportunities for pollution of the underground waters in this vicinity. Accordingly the use of these wells should be continued only until a new permanent supply is obtained. Studies are now under way for this purpose and should be completed at the earliest possible time.

In addition to the water from the public supply, numerous local wells scattered throughout the village have been used by the public. Many of these wells have very insanitary conditions in their vicinity. Inspections were made of, and samples collected from, several of these wells. The analyses show that the waters from practically all of these wells are derived from seriously-polluted ground-water

sources, and while certain of the wells are apparently less actively contaminated than others, it is impossible to predict that such a condition will continue at all times and under all circumstances. It was therefore recommended by us, in a letter published in the local press, that all water from these wells be boiled for drinking and culinary purposes.

In the previous report a table giving case data was appended, together with a chart, showing the curve of onset dates. This table and chart were based upon the information secured with respect to some 93 cases. Since this previous report 62 additional cases have been reported, and the data with respect to the entire 155 cases have been tabulated and studied. The data given in the table of the previous report were somewhat incomplete and in some cases incorrect, due to inherent difficulties in the rather hasty compilation of the information. It is believed, however, that the revised table is much more complete and accurate, and upon it a new curve of onsets has been based. This revised table gives no information with respect to possible sources of infection other than water, milk, and contact, it being found early in the investigation begun by the Division of Communicable Diseases that the evidence pointed so overwhelmingly toward the water supply as the source of outbreak that the tabulation of additional information with respect to food supplies would have been superfluous.

From the chart of onsets (Fig. 1) it will be seen that the larger number of onsets occurred between the middle of September and the middle of October, approximately three to four weeks subsequent to the pumping of unchlorinated canal water into the distribution system. If the average period of incubation in water-borne outbreaks of typhoid fever is taken as from one to two weeks, it would appear probable that there had first been a slight infection of the water supply, followed after a few days by a more massive one. The large group of cases with onsets on September 20 would place this infection in the week beginning September 1. Another group of cases had onsets between the first and middle of November, and while a certain proportion of these cases may have been due to contact with cases occurring in the first group, it appeared from records of operation of chlorination plants and results of analyses that insufficient application of chlorine occurred at times up to November 25, when the operation of the chlorine apparatus was taken over by the Division of Engineering. Since this time, however, only a few scattering cases have occurred, and the majority of these are probably of secondary origin.

While the great majority of cases gave evidence of having used unboiled village water for drinking purposes, and while the evidence with respect to the use of raw canal water indicated clearly the vil-

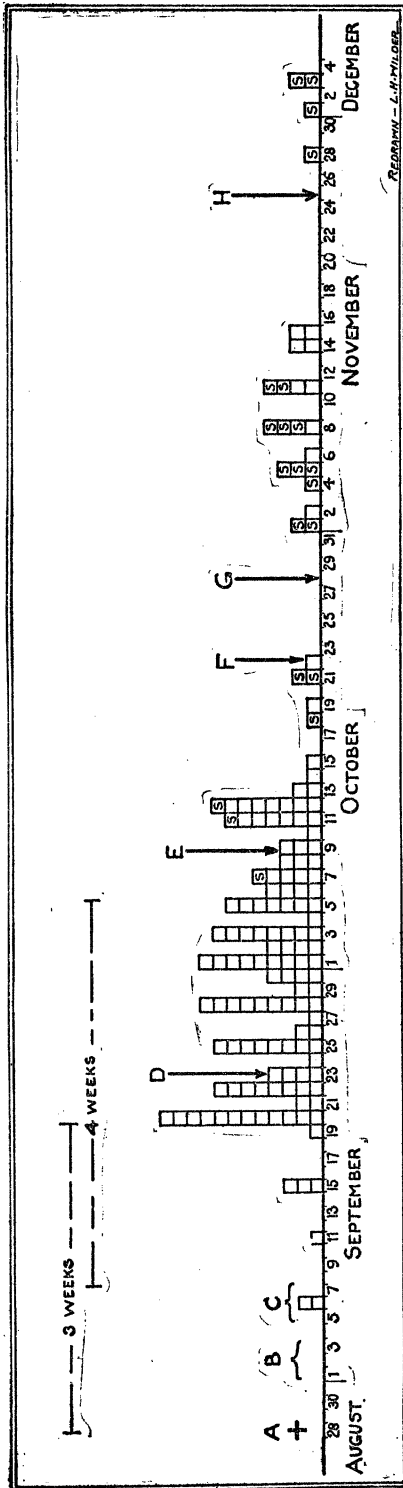


FIG. 1.—Number of cases, by dates of onset, of typhoid fever at Herkimer, N. Y., 1918.

NOTE.—Each square represents 1 case. S represents a secondary or possible contact case; A, unchlorinated canal water pumped; B, unchlorinated well water pumped; C, unchlorinated canal and well water pumped; D, use of canal water first brought to the attention of the State department of health; E, F, inspection of water supply made by the Division of Sanitary Engineering; G, second chlorination apparatus installed at pumping station; H, supervision of chlorination begun by the Division of Sanitary Engineering.

lage water supply as the principal source of the infection, yet as evidence warranting the exclusion of milk as a possible source, the case data have been summarized as follows with respect to the milk supplies used by various cases:

TABLE 1.

Milk dealers.	Quarts of milk delivered.	Per cent.	Cases.	Per cent.
Sanitary Milk Co.....	1,100	47	57	42
Lovior & Putnam.....	500	21	42	31
Ray.....	250	11	20	15
Potter.....	300	13	12	9
Guyer.....	150	6	4	3
Martindale.....				
Moore.....	50	2	2	1
Total supplied by principal dealers.....			137	
Chapman.....			1	
Own cow.....			1	
Condensed milk.....			1	
Unknown.....			15	

From this table it will be seen that the distribution of cases along milk routes is approximately in proportion to the quantity of milk delivered by the various dealers, no preponderance of cases occurring upon the route of any one dealer. It was considered advisable, however, in order to minimize the danger of the spread of the disease through milk bottles, to require that no milk bottles be delivered to houses in which typhoid occurred. This requirement was put into effect about the 1st of December and the milk inspector was instructed to follow up the matter.

With respect to age distribution the following summary has been made:

TABLE 2.

Age.	Cases.	Percentage.
0 to 10.....	46	30
10 to 20.....	44	29
20 to 30.....	28	18
30 to 40.....	15	10
40 to 50.....	13	8
50 to 70.....	7	5
Total of known ages.....	153	100
Unknown.....	2	

Although the number of cases amongst children up to 10 years of age is somewhat larger than is usually found in water-borne typhoid fever outbreaks, it should be noted that of the 46 cases within this age group some 14 are probably secondary in origin as they occurred in households having earlier cases of typhoid.

The high mortality, some 28 deaths among 155 reported cases, indicates incomplete reporting of mild cases. It should be noted, however, that this outbreak of typhoid occurred during the influenza epidemic of last fall and, accordingly, errors in diagnosis may

have been made. Furthermore, complications with influenza may have increased the fatality of the typhoid in some cases.

In order to prevent so far as possible the occurrence of additional cases, of either secondary or primary origin, a general letter of instruction and warning to the residents of the village was given to the press and also distributed throughout the village on handbills about the 1st of December. This letter contained specific directions and precautions to be followed by everyone in the village with reference to boiling water and milk, isolation of cases of typhoid fever, use of disinfectants and other essential matters. An emergency hospital established by the village was used to care for a number of cases and the village nurse, Miss Hofmeister, gave individual assistance and instructions at the homes of the majority of cases.

#### SUMMARY.

From the evidence presented in this report with its appended tables, it may be concluded—

(1) That the outbreak of typhoid fever in Herkimer was brought about by the pumping of unchlorinated and infected creek water into the village mains.

(2) That, at the time of this present report, it appears probable that the outbreak has been definitely checked.

(3) That, although the operation of the chlorination apparatus has apparently been efficient since the latter part of November, the character of the creek water is such that chlorination alone can not be considered as a sufficiently practical and reliable safeguard under all conditions.

(4) That, in view of the difficulty of adequately chlorinating a water of this character, the supervision of the chlorination of the water supply by men specifically detailed for this purpose is absolutely necessary.

(5) That the majority of local wells in the village are derived from polluted ground water sources and are a potential menace to health.

(6) That, although the new wells for the public supply will probably yield a supply more easily chlorinated than the creek supply, they are somewhat unsatisfactorily located with respect to possible sources of pollution of the ground water tributary to them.

(7) That the village urgently needs the development of a new source of water supply, of adequate quantity and of satisfactory quality.

It is therefore, recommended—

(1) That the temporary auxiliary water supply from the driven wells be secured as soon as possible.

(2) That the present use of creek water be abandoned as soon as the new well supply will permit.

(3) That all water admitted to the distribution system of the village, either from the wells or from any other source, be adequately and properly chlorinated.



(4) That until the use of creek water has become unnecessary and as an added safeguard in view of the difficulties of chlorination above referred to, all water for drinking and culinary purposes be boiled.

(5) That the use of local wells in the village be abandoned.

(6) That the village authorities take decisive steps at once toward the introduction at the earliest practicable time of a new permanent water supply of ample quantity and of satisfactory quality.

TABLE 3.—Results of water analyses.

Source of sample.	Date of collection.	Bacteria per c. c. gelatin, 20° 48 hours.	B. coli type, +=present, —=absent.		
			10 c. c.	1 c. c.	1/8 c. c.
Raw creek water.....	July 12, 1918	750	3+, 0—	3+, 0—	3+, 0—
Filtered creek water.....	do.....	250	3+, 0—	3+, 0—	3+, 0—
Tap, Palmer House, chlorinated.....	do.....	26	0+, 3—	0+, 3—	0+, 3—
Raw, hydraulic canal.....	Sept. 24, 1918	13,000	3+, 0—	3+, 0—	3+, 0—
Tap, East German Street, chlorinated.....	do.....	10	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Oct. 9, 1918	4,100	3+, 0—	3+, 0—	3+, 0—
Chlorinated creek water.....	do.....	325	3+, 0—	3+, 0—	0+, 3—
Chlorinated mixed supply.....	do.....	70	0+, 3—	0+, 3—	0+, 3—
Public fountain, chlorinated.....	do.....	30	2+, 1—	0+, 3—	0+, 3—
Raw creek water.....	Oct. 22, 1918	5,900	3+, 0—	3+, 0—	3+, 0—
Chlorinated creek water.....	do.....	16	3+, 0—	0+, 3—	0+, 3—
Raw well water.....	do.....	30	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	71	0+, 3—	0+, 3—	0+, 3—
Tap, Palmer House, chlorinated.....	do.....	18	1+, 2—	0+, 3—	0+, 3—
Raw creek water.....	Nov. 26, 1918	750	3+, 0—	3+, 0—	2+, 1—
Chlorinated creek water.....	do.....	10	0+, 3—	0+, 3—	0+, 3—
Raw well water.....	do.....	75,000	2+, 0—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	20	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	15	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 3, 1918	300	3+, 0—	3+, 0—	2+, 1—
Chlorinated creek water.....	Dec. 2, 1918	2	0+, 3—	0+, 3—	0+, 3—
Raw well water.....	do.....	300	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	0	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	1	0+, 3—	0+, 3—	0+, 3—
Tap, Main Street, chlorinated, mixed, a. m.....	Dec. 3, 1918	5	0+, 3—	0+, 3—	0+, 3—
Tap, Mohawk Street, chlorinated, mixed.....	do.....	450	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated mixed, p. m.....	do.....	4	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 5, 1918	325	3+, 0—	3+, 0—	1+, 2—
Chlorinated creek water.....	do.....	3	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	30	0+, 3—	0+, 3—	0+, 3—
Tap, Palmer House, chlorinated mixed.....	do.....	2	0+, 3—	0+, 3—	0+, 3—
Chlorinated creek water.....	Dec. 6, 1918	16	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	2	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	203	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 10, 1918	1,300	3+, 0—	3+, 0—	2+, 0—
Chlorinated creek.....	do.....	8	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	550	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	39	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 12, 1918	450	3+, 0—	3+, 0—	0+, 3—
Chlorinated creek water.....	do.....	5	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	30	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	12	0+, 3—	0+, 3—	0+, 3—
Chlorinated creek water.....	Dec. 16, 1918	5	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	1	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed, 3.30 p. m.....	do.....	2	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed, 4.30 p. m.....	do.....	5	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed, 2 p. m.....	Dec. 19, 1918	2	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed, 10 a. m.....	Dec. 20, 1918	3	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 24, 1918	2,000	3+, 0—	3+, 0—	2+, 1—
Chlorinated creek water.....	do.....	19	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	12	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	11	0+, 3—	0+, 3—	0+, 3—
Do.....	do.....	6	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 27, 1918	430	3+, 0—	3+, 0—	0+, 3—
Chlorinated creek water.....	do.....	7	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	5	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed.....	do.....	3	0+, 3—	0+, 3—	0+, 3—
Raw creek water.....	Dec. 30, 1918	200	3+, 0—	3+, 0—	1+, 2—
Chlorinated creek water.....	do.....	1	0+, 3—	0+, 3—	0+, 3—
Chlorinated well water.....	do.....	2	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed, 10.10 a. m.....	do.....	2	0+, 3—	0+, 3—	0+, 3—
Tap, chlorinated, mixed, 3 p. m.....	do.....	2	0+, 3—	0+, 3—	0+, 3—